SNI

Standar Nasional Indonesia

SNI 15-3758-2004

Masonry cement

BSN
Gd. Manggala Wanabakti
Blok IV, Lt. 3,4,7,10.
Telp. +6221-5747043
Fax. +6221-5747045
Email: dokinfo@bsn.go.id
www.bsn.go.id

Published in Jakarta

Translation Disclaimer

Should confusion arise in the interpretation of the English version of this SNI, please refer to the Indonesian version

Table of contents

Foreword

This SNI 15-3758-2004 *Semen masonry,* is a revised edition of SNI 15-3758-1995, *Semen aduk pasangan*

This standard was revised following revisions made in ASTM C-91, *Standard specification for masonry cement* which is used as the main reference and applied by all cement industries and testing laboratories.

This standard was developed and prepared by Technical Committee 33S, Inorganic Chemistry and is a result of a consensus meeting held in Jakarta on March 24, 2004; attended by representatives of manufactures, consumers, associations, test institutions and government departments.

Masonry cement

1 Scope

This standard covers scope, normative reference, terms and definitions, types and use, selection guides, quality specifications, sampling, test method, acceptance requirements, packaging, marking, storage and transportation of masonry cement.

2 Normative reference

SNI 15-2049-2004, *Semen portland.*

SNI 15-3500-2004, *Semen portland campur.*

ASTM C 91, *Standard specification for masonry cement.*

ASTM C 1506, *Standard test method for water retention of hydraulic cement – based mortars and plasters.*

3 Terms and definitions

3.1
masonry cement
hydraulic cement, mainly used for wall plastering and plastering of constructions, consisting of a mixture of Portland cement or a mixture of hydraulic cement with materials to improve plasticity (such as lime, dehydrated lime or hydraulic lime) together with other materials to increase one or more properties such as setting time, workability, water retention and durability

3.2
type N masonry cement
masonry cement used to make a mixture for plastering, so that the prepared plaster comply to the quality requirements of type N plaster mix, or when Portland cement or hydraulic cement is added, the mix can satisfy the quality requirements of type S or M

3.3
type S masonry cement
masonry cement used to make a mixture for plastering, so that the prepared plaster comply to the quality requirements of type S plaster mix, or when Portland cement or hydraulic cement is added, the mix can satisfy the quality requirements of type M.

3.4
type M masonry cement
masonry cement used to make a mixture for plastering, so that the prepared plaster comply to the quality requirements of type M plaster mix

3.5
mixed Portland cement
hydraulic binding material a result of milling together of Portland cement slag and gypsum with one or more inert organic material

3.6
Ottawa standard sand
silica sand consisting mostly of natural rounded shape pure quartz and used to prepare mortar mix for hydraulic cement testing

3.7
gradated sand
Ottawa standard sand graded by sieving between the 0,600 mm (No. 30) sieve and 0,150 mm (No. 100) sieve

3.8
graded 20 – 30 Ottawa standard sand
standard sand predominantly passing 0,850 mm (No. 20) sieve and retained by 0,600 mm (No. 30) sieve

4 Guidance to select masonry cement

Guidance and selection of masonry cement is shown in Table 1 below:

Table 1 - Guide for the selection of masonry cement

No.	Location	Building type	Mortar type	
			Recommended	Selection
1.	Buildings unprotected from the environment			
	- Upper building	- Load bearing wall	S	M
		- Non load bearing wall	N	M or S
		- Side wall	N	S
	- Lower building	Foundation, hole enforcement, sewage, pavement, terrace	S	M or N
2.	Buildings protected from environment	Load bearing wall	S	M
		Load bearing partition	S	M
		Non load bearing partition	N	S or M

5 Quality requirements

5.1 Masonry cement shall comply with the requirements applicable and explained in Table 2.

Table 2 - Physical requirements

No	Description	*Units*	*Type*		
			Type N	Type S	Type M
1	Fineness residue on a 45 µm sieve	%	max. 24	max. 24	max. 24
2	Shape consistency by autoclave expansion test	%	max. 1,0	max.1,0	max.1,0
3	Time of setting by Gillmore apparatus Initial set Final set	 minutes minutes	 min. 120 max.1440	 min.90 max.1440	 min.90 max.1440
4	Compressive strenght (average value of 3 cubes) 7 days 28 days	 kg/cm^2 kg/cm^2	 min. 35 min. 63	 min. 92 min. 148	 min. 126 min. 204
5	Air content of mortar	% volume % volume	min. 8 max. 21	min. 8 max. 19	min. 4 max. 19
6	Water retention value,	% original flow	min.70	min.70	min.70

6 Sampling

Number of masonry cement samples taken and sampling methods shall be in accordance with SNI 15-2049-2004, *Semen Portland*

7 Test method

7.1 Fineness

Fineness test by mesh 45 µm (No. 325) sieve shall be in accordance with SNI 15-3500-2004 *Semen Portland campur*

7.2 Shape consistency by autoclave expansion test

Shape consistency test by autoclave expansion shall be in accordance with SNI 15 –2049–2004, *Semen Portland*

7.3 Time of setting

Determination of the time of setting by Gillmore apparatus shall be in accordance with ASTM C 91, *Standard specification for Masonry cement.*

7.3.1 Apparatus

1) Mixing apparatus, mixer, mixing bowl, trowel, glass graduates, weighing devices and weights in accordance with SNI 15-2049-2004 Semen p*ortland*
2) Rectangular abrasive proof glass plate with sides measuring 102 mm ± 3 mm
3) Gillmore apparatus shall conform to the following requirements:
   Initial set needle
   - Weight : 113,4 g ± 0,5 g

- Diameter : 2,12 mm ± 0,05 mm

Final set needle
- Weight : 453,6 g ± 0,5 g
- Diameter : 1,06 mm ± 0,05 mm

The needle shall be cylindrical and 4,8 mm ± 0,5 mm in length. The needle end shall be flat, and shall be centered exactly at the axis. The needle end and the stem shall be in perfect and clean condition. (See Figure A.1 in Appendix A)

7.3.2 Operation method

1) Preparation of cement paste
   In accordance with SNI 15-2049-2004 *Semen Portland*
2) Molding of test specimen
   a. Form the cement paste into a slab with sloping edges
      - Bottom diameter : 76 mm ± 13 mm
      - Top diameter : 50 mm ± 13 mm
      - Thickness at center: 13 mm ± 3 mm
   b. Place the slab on top of glass plate and form the sloping edges (See Figure A.2 in Appendix A)
   c. Molding of the slab
      (1) Place a lump of cement paste on top of glass plate
      (2) Form the slab by moving the triangle mixing knife with straight edges from the edges to the centre of the paste lump.
      (3) After finishing, store the specimen in a moist cabinet and leave for some time, except for the sample to determine the time of setting
   d. Determination of setting time

(1) Place the specimen under the Gillmore needle
(2) Hold the needle perpendicular to the paste surface
(3) Adjust the needle and release slowly

NOTE

a) Initial setting is reached when the specimen can withhold the initial setting needle without leaving a trace
b) The difference in minutes, starting from cement mixing with water and the moment the cement paste reach initial setting is the initial setting time
c) The final setting time is reached when the specimen can withhold the final setting needle without leaving a trace
d) The time difference in minutes after mixing the cement with water and the time when the cement paste reached its final setting is the final setting time

7.4 Compressive strength

7.4.1 Test apparatus

The apparatus needed shall be in accordance with SNI 15-2049-2004 *Semen Portland*

7.4.2 Operation methods

The testing of compressive strength of masonry cement shall conform to the applicable method prescribed in ASTM C 91, *Specification for masonry cement*

7.4.2.1 Preparation of mortar

The mortar for compressive strength, air entrainment and water retention determination shall be prepared in accordance with this method.

7.4.2.1.1 Mortar composition

Proportions standard mortar using cement and 1620 g standard Ottawa sand in volume proportion of 1 : 3
The standard sand shall consist of 810 g standard Ottawa sand and 810 g of 20 – 30 graded standard sand in accordance with Table 5. The quantity of water measured in ml, shall be such to produce a flow of (110 ± 5) % determined by flow table in accordance with SNI 15-2049-2004 *Semen Portland*
The weight proportion of cement mass to standard Ottawa sand in the mortar is mentioned in Table 3.

Table 3 - Cement mass in mortar

Masonry cement type	Units	Mass of cement	Mass of standard sand
N	grams	480	1620
S	grams	510	1620
M	grams	540	1620

For the other masonry cement type mass per 28 L, Table 4 below shall be consulted

Table 4 - Masonry cement mass in 28 L

Masonry cement type	Units	Mass
N	kgs	32
S	kgs	34
M	kgs	36
NOTE Cement mass in Table 4 is used as C in equation $A = 1620 \times (C/B)$		

Calculation example
The amount of cement needed to provide a 1 : 3 cement and standard sand volume proportion as stated in Table 3 is as follows:

$A_N = 1620 \times (C/B) = 1620 \times (32/108) = 480$ g
$A_S = 1620 \times (C/B) = 1620 \times (34/108) = 510$ g
$A_M = 1620 \times (C/B) = 1620 \times (36/108) = 540$ g

with :

A_N is the number of grams of Type N masonry cement to be used in the mortar with 1620 g sand,
A_S is the number of grams of Type S masonry cement to be used in the mortar with 1620 g sand,
A_m is the number of grams of Type M masonry cement to be used in the mortar with 1620 g sand,

B is 3 times the mass of dry sand in 28 L (3 x 36 = 108 kg);
C is the mass of Type N masonry cement (per 28 L).

7.4.2.1.2 Standard sand

Standard sand used is a blend of graded standard Ottawa sand and standard 20-30 Ottawa sand in accordance with Table 5

Table 5 - Standard sand requirements

Sieve size/number	Units	Retained on sieve	
		Graded 20 – 30 Standard Ottawa Sand	Standard Ottawa sand
1180 µm (No. 16)	%	100	100
850 µm (No. 20)	%	85 - 100	
600 µm (No. 30)	%	0 - 5	95 – 100
425 µm (No. 40)	%		65 – 75
300 µm (No. 50)	%		20 – 30
150 µm (No. 30)	%		0 – 4

7.4.2.1.3 Determination of mortar flow

Mortar flow determination shall be in accordance with SNI 15-2049-2004 *Portland cement*

7.4.2.1.4 Mortar preparation

Mortar preparation shall be in accordance with SNI 15-2049-2004 *Portland cement*

7.4.2.2 Molding of the specimen

Immediately after determining the flow of mortar in accordance with 7..6.2.4).a and mass of 400 ml mortar, return the mortar to the mixing bowl and remix for 15 seconds at medium speed.
Mold the test specimen in accordance with SNI 15-2049-2004 *Portland cement*

7.4.2.3 Storage of specimens

a) Immediately after molding store all specimens in a moist cabinet with a minimum relative humidity of 95 % and a temperature of 23 °C ± 2 °C for (48 – 52) hours
b) Remove the specimens from the molds and store in a moist cabinet for 5 days in such a manner as to allow free circulation of air
c) At the age of 7 days, immerse the specimens for the 28 day compressive strength tests in a non corrosive tank containing saturated lime water

7.4.2.4 Determination of compressive strength

a) For the 7 days test, test the specimen immediately after removal from the moist cabinet
b) Cover the other specimen with a damp cloth until the time of testing
c) For the 28 days test, after removal of the specimen from the immersion tank immerse the specimen in a tank filled with water having a temperature of (23 ± 2) °C until the time of testing.
d) Determine the compressive strength of each specimen in accordance with test procedure in SNI 15-2049-2004 *Portland cement*

7.4.3 Calculation

Calculate and report the compressive strength in accordance with SNI 15-2049-2004 S*emen Portland*

7.5 Air content

7.5.1 Apparatus

Apparatus and ancillary equipment shall conform to the requirements in SNI 15-2049-2004 *Semen Portland*

7.5.2 Operation procedures

Air content test shall be determined in accordance with ASTM C 91, *Standard Specification for masonry cement*

1) Density determination

a. Apparatus

(1) Le-Chateleir flask
(2) Glass funnel with short stem
(3) Tank containing water
(4) No. 7 brush
(5) Thermometer
(6) Analytical weighing device with an accuracy of 0,0001 g, and a capacity less than 200 g

b. Material

Water free kerosene or naphtha with a density of ≥ 62 API

c. Procedures

(1) Fill the Le-Chatelier flask with either of the liquids specified in 7.8.2 up to the 0 ml – 1 ml mark at the flask stem
(2) Dry the inside of flask stem above the liquid level using filter paper
(3) Slowly introduce 64 g ± 0,05 g cement into the Le-Chatelier flask, the temperature of cement shall be equal to the temperature of the liquid in the flask
(4) Read the first indication after the flask is immersed into a tank containing water with a fixed temperature. Avoid splashing of the liquid and see that no cement adhere to the inside of the neck above the liquid surface
(5) A vibration device may be used to accelerate the introduction of cement
After all cement is introduced, cover the flask, roll the flask in an inclined position, and slowly whirl it in a horizontal circle, until no air bubbles are present. If a proper quantity of cement has been added, the position of the upper surface of liquid is located at the upper graduation of the scale.
(6) Immerse the flask in the water-tank having a fixed temperature for a sufficient period of time, until the variations in temperature between the initial and final reading does not exceed 0,2 ^{o}C.

d. Calculation

The difference between the initial reading and final reading indicate the liquid volume occupied by the cement specimen mass.

Density of cement = A / B

where
A is cement mass, g;
B is the volume of displaced liquid, cm^3

2) Preparation of specimen
Prepare specimen In accordance with procedures in 7.4.1 up to 7.4.2

3) Preparation of mortar preparation
Prepare the mortar In accordance with procedure 7.4.4

3) Determination of air content

a. Determination of mortar flow

(1) Clean the flow table and wipe dry with a cloth
(2) Place the mold in the centre of the flow table
(3) Fill the mold with a layer 25 mm in thickness
(4) Stamp the mortar paste with a tamper and tamp 20 times
The tamping pressure shall be just sufficient to ensure uniform filling
(5) Repeat filling until the mold is full and tamp as specified for the first layer
(6) Flatten the top surface of the mortar with a mixing knife in two perpendicular directions
(7) Clean and dry the surface of the flow table and around the edge of the mold
(8) Lift the mold away from the mortar 1 minute after completing the operation
(9) Drop the flow table through the specified height of 12,7 mm, 25 times in 15 seconds
(10) The average flow is measured with a caliper, determined 4 times at different angles
(11) The test result is expressed as a percentage of the original diameter
Repeat the trial mentioned above with a varying percentage of water until the specified flow is obtained. Make each trial with fresh mortar.

b. Determination of air content

(1) After obtaining mortar with the specified flow, immediately store the rest of the mortar of 400 ml in the mixing bowl
(2) Using a spoon place the mortar in the volumetric glass in 3 layers
(3) Each layer shall be tamp 20 times using a tapping stick around the inner sides of the mold
(4) While tamping the first layer, do not strike the bottom of the mold. During the second and the last tamping it is sufficient to ensure uniform filling of each mortar layer
(5) To avoid entrapment of air in the mortar, lightly tab the sides of the apparatus with a tapping stick at 5 different points around the outside of the apparatus, 1 tab at each location.
(6) Cut the mortar off to a plane surface in the apparatus with a mixing knife in 2 perpendicular directions.
(7) If in the striking of operation, loose sand grains from the mortar cause scratches, repeat the operation.

Complete the entire procedures in 7.5.2.4) within 1,5 minutes. Wipe off the mortar and water leaving the apparatus.

c. Weigh the measuring apparatus and its contents, and then calculate the mortar mass in grams

d. Calculation

Calculate the air content of the mortar and report it with an accuracy of 1% as follows:

$$D = \frac{W_1 + W_2 + V_w}{\left[\frac{W_1}{S_1} + \frac{W_2}{S_2} + (V_w)\right]}$$

$$A = 100 - (W_m/4D)$$

where:

D is the density of air free mortar, g/cm^3
W_1 is the mass of cement, g;
W_2 is the mass of sand, g;
V_w is the volume of water used, cm^3
S_1 is the density of cement, g/cm^3
S_2 is the density of standard sand, 2,65, g/cm^3
A is the volume percent of entrained air, % volume;
W_m is the mass of 400 mL of mortar, g.

7.6 Water retention

The water retention test is carried out in accordance with ASTM C 1506, *Standard test method for water retention of hydraulic cement – based mortars and plasters*

7.6.1 Apparatus

1) The apparatus used for the water retention test is shown in Figure 3 and Figure A.4 in Appendix A.
2) A triangular knife made from steel, with straight edges and a length not less than 200 mm and between 2 mm and 3 mm thick.
3) Other ancillary apparatus required shall conform to the requirements in 7.4.1

7.6.2 Operation methods

a) Adjust the mercury column to obtain and maintain a vacuum of 51 mm ± 3 mm as indicated by the manometer
b) Seat a perforated disk on top of the greased funnel
c) Place a wetted filter paper at the bottom of the perforated disk
d) Turn the stopcock to apply vacuum to the funnel and check the apparatus for leaks and determine that the required vacuum is obtained.
e) Open the stopcock to interconnect the system and to expose it to the atmospheric pressure
f) Mortar preparation
g) Mortar preparation in accordance to requirements in 7.4.2.1
h) Calculation

Calculate the water retention value for the mortar as follows:
Water retention value = (A/B) x 100%
where:
A is the flow after suction, %
B is the flow after mixing, %

8 Acceptance requirements

The tested masonry cement is accepted whenever all requirements in 5 are satsfied and tested according to the procedures in 7

9 Packaging

9.1 Masonry cement is delivered in packages or bulk. Masonry cement shall be delivered in packages of 40 kg net mass

9.2 Packages more than 2 % below the mass marked thereon shall be rejected. The average mass of a delivery represented by weighing 50 packages at random shall not be less than the weight marked on the packages.

10 Marking

Each package shall at least be marked as follows:

1) Masonry cement
2) Trade mark
3) Type of cement
4) Name of manufacturer
5) Net mass

For masonry cement the information shall be provided in the shipment documents

11 Storage and transportation

11.1 The cement shall be stored or transported in such a manner as to permit easy access for proper inspection and identification.

11.2 Bulk cement shall be stored in weather tight buildings/warehouses that will protect the cement from the dampness and minimize warehouse set during storage.

11.3 During storage or transportation the cement packages shall be protected from environmental conditions.

Appendix A
(Informative)

Test Apparatus

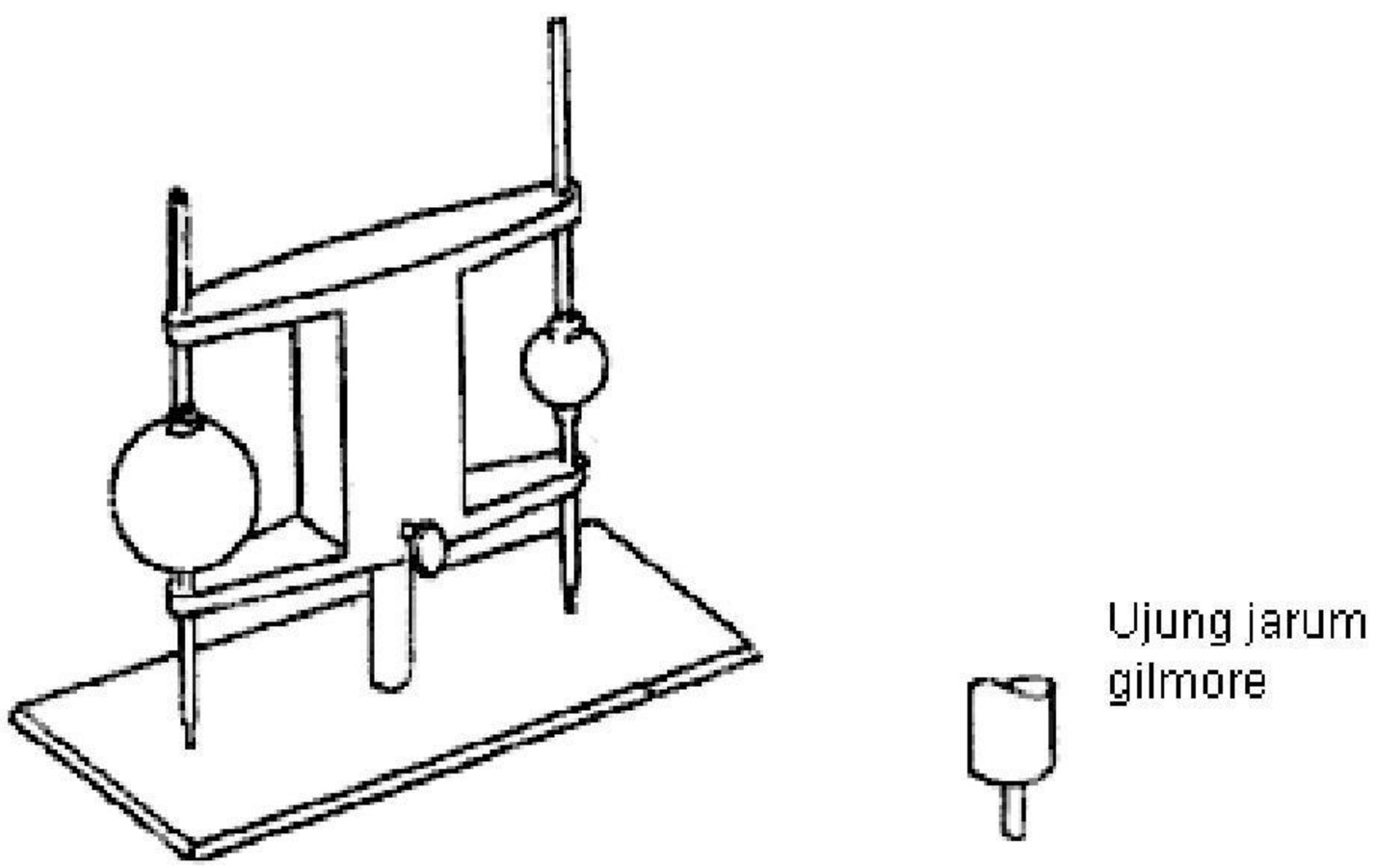


Figure A.1 - Gilmore aparatus

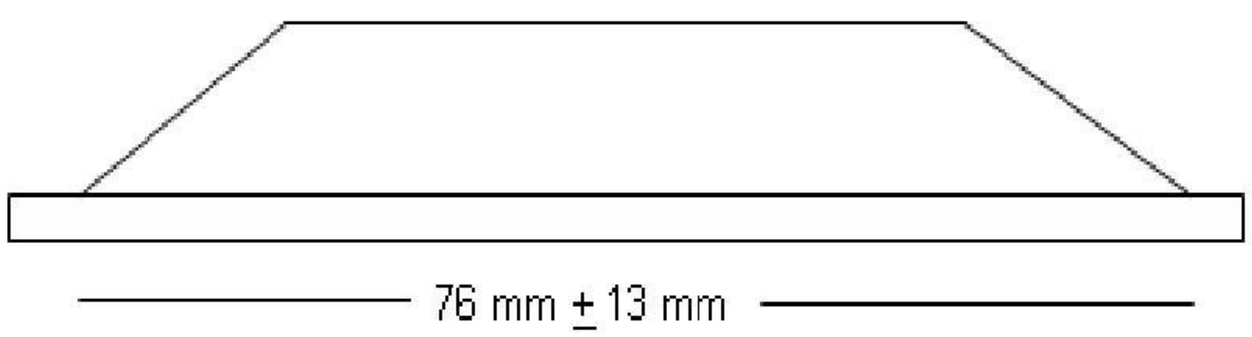
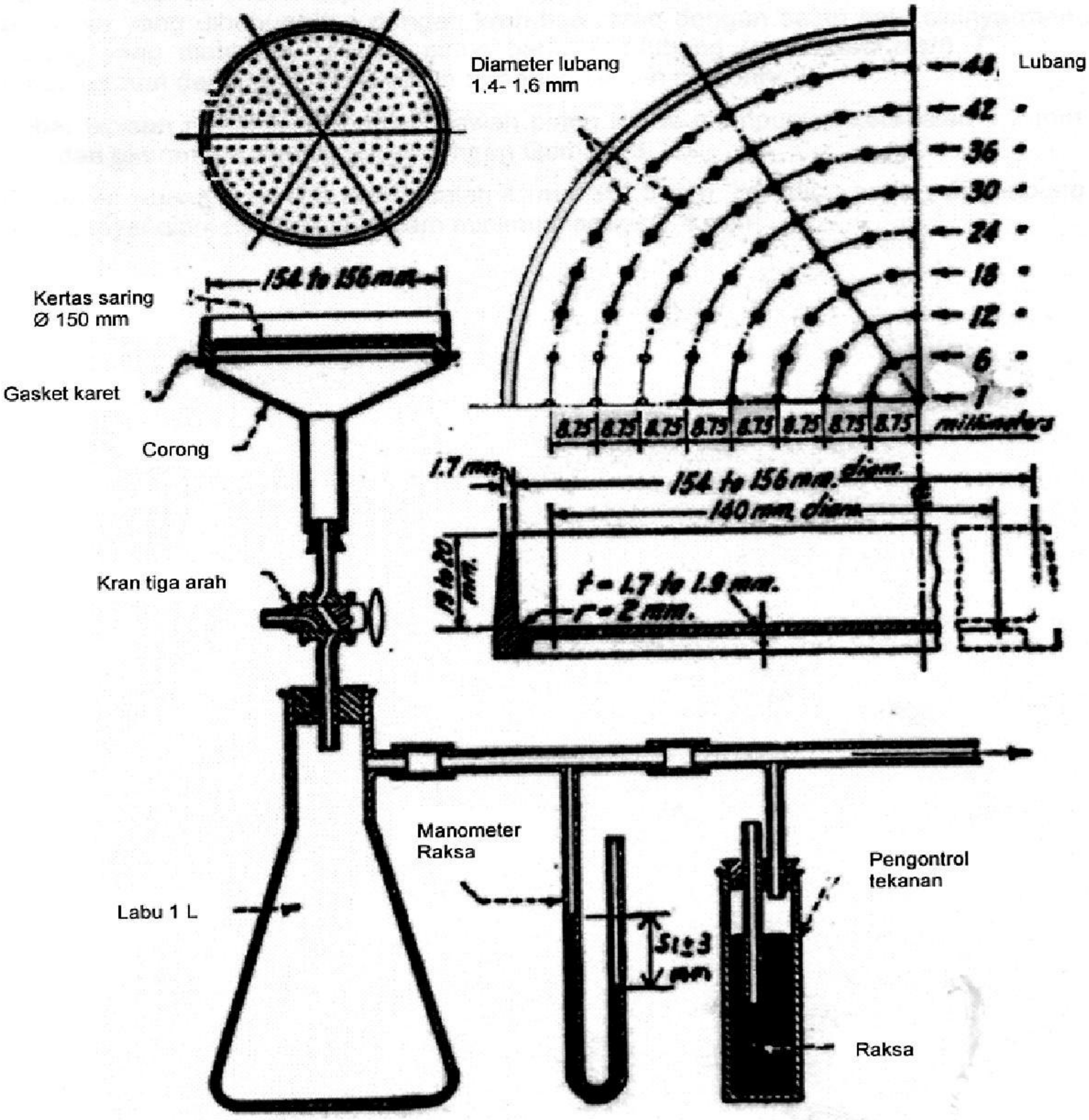


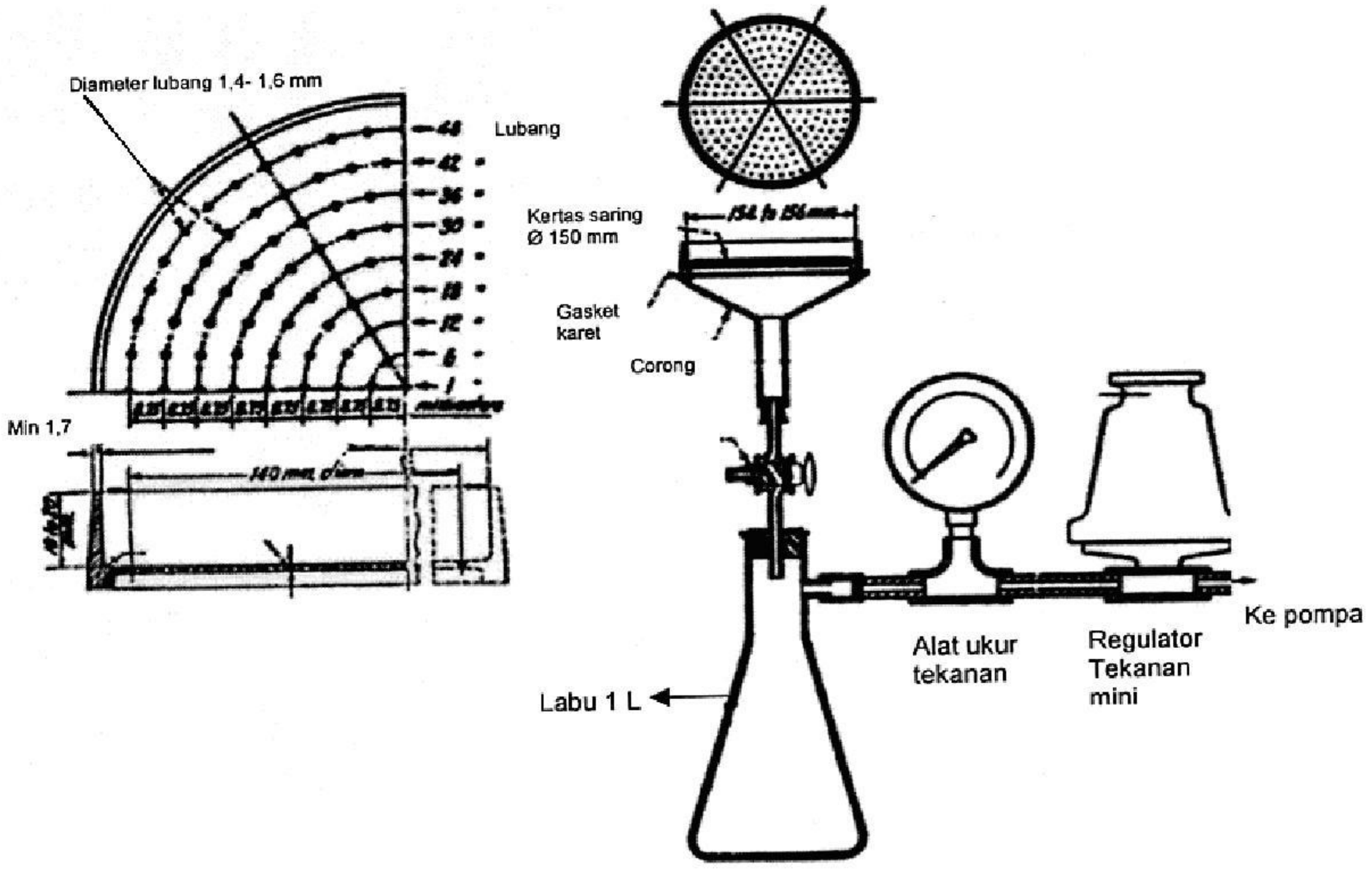
Figure A.2 - Cement paste plate



Keterangan gambar
Diameter lubang = Diameter of holes 1.4 – 1.6 mm
Kertas saring = Filter paper ∅ 150 mm
Gasket karet = Rubber seal
Corong = Funnel
Kran tiga arah = Three way stop cock
Labu 1 l = 1 l flask
Lubang = Hole
Manometer raksa = Mercury manometer
Pengontrol tekanan = Pressure regulator
Raksa = Mercury

NOTE Water aspirator or alternate apparatus controlled by a column of mercury connected to a three way stop cock with one side connected to a funnel with a perforated dish on top of it. The dish shall be made from steel resistant to contamination of mortar mixtures.
The metal thickness at the bottom of the dish shall be 1,7 mm – 1,9 mm and its dimensions shall conform to Figure A.3
The hole diameter of the three way stop cock is 4 mm ± 0,5 mm, and the connecting glass pipe shall have a minimum diameter of 4 mm.

Figure A.3 - Apparatus assembly for the water retention test



Keterangan gambar

Diameter lubang = Diameter of holes 1.4 – 1.6 mm
Lubang = Hole
Kertas saring = Filter paper ∅ 150 mm
Gasket karet = Rubber seal
Corong = Funnel
Labu 1 l = 1 l flask
Alat ukur tekanan = Pressure gauge
Regulator tekanan mini = Miniatur pressure regulator
Ke pompa = To pump

Figure A.4 - Apparatus assembly for the water retention test (alternate)

Bibliography

ASTM C 270, *Specification for mortar for unit masonry.*

BADAN STANDARDISASI NASIONAL - BSN
Gedung Manggala Wanabakti Blok IV Lt. 3,4,7,10
Jl. Jend. Gatot Subroto, Senayan Jakarta 10270
Telp: 021- 574 7043; Faks: 021- 5747045; e-mail : bsn@bsn.go.id